International Journal of Community Medicine and Public Health
Bashar MA et al. Int J Community Med Public Health. 2025 Feb;12(2):1128-1130
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20250333

Review Article

Dengue outbreak of 2023 in the state of Uttar Pradesh, North India: lesson learnt and way forwards

Mohammad Abu Bashar[1]*, Nazia Begam[2]

[1]Department of Community and Family Medicine, All India Institute of Medical Sciences, Gorakhpur, Uttar Pradesh, India
[2]Shri Gorakshnath Medical College Hospital & Research Centre, Gorakhpur, Uttar Pradesh, India

Received: 08 November 2024
Revised: 14 December 2024
Accepted: 19 December 2024

***Correspondence:**
Dr. Mohammad Abu Bashar,
E-mail: imback20006@yahoo.in

ABSTRACT

Dengue, a vector borne viral disease, is endemic in most areas of India and sometimes causes yearly epidemics. Each of the dengue outbreaks causes high death and morbidity, which has a significant socioeconomic impact. In the year, 2023, India had clocked 2, 89,235 dengue cases with 485 deaths in the year 2023, highest in the last 5 years, as per the information provided by the National Centre for Vector Borne Diseases Control. Northern India is most severely impacted by each outbreak. In the state of Uttar Pradesh, the most populous state of India, there have been more than 35,000 confirmed cases of dengue and 36 deaths reported in 2023 alone. Patients are being reported from urban as well as semi-urban, and rural areas. It is necessary to properly monitor the dengue cases through both active and passive disease surveillance in order to ensure prompt case management if dengue outbreak control is to be achieved.

Keywords: Dengue, Outbreak, Uttar Pradesh, India, Cases, Deaths

INTRODUCTION

Dengue is a viral infection caused by the dengue virus (DENV), transmitted to humans through the bite of infected mosquitoes.[1] About half of the world's population is currently at risk of dengue with an estimated 100–400 million infections occurring each year and 70% of the disease burden is in Asia.[1,2] Dengue is found in tropical and sub-tropical climates worldwide, mostly in urban and semi-urban areas.[1] Dengue is transmitted by *Aedes* mosquitoes, particularly *Aedes aegyptii* and, less importantly, *Aedes albopictus*. During the last 200 years, spread of the disease has increased, reaching endemic proportions during the last three decades in more than 120 countries.[3]

In India, the first virologically confirmed epidemic of dengue occurred in Calcutta (now Kolkata) and the eastern coast of India in 1963-1964.[4] A major widespread epidemic of dengue haemorrhagic fever (DHF) occurred in 1996 involving areas around Delhi and Lucknow.[5,6] Since then, there has been a remarkable resurgence of the infection in North Indian plains that include the State of Uttar Pradesh. Once considered an urban disease, it has now made ways into rural areas as well, due to high population density and other factors.[7] Some major outbreaks of dengue have occurred in North India.[8]

DENGUE OUTBREAK OF 2023

The year 2023 saw an unprecedented increase in vector Borne diseases, primarily dengue and malaria. As per National Vector Borne Disease Control Program reports, the number of dengue cases in India has crossed 2, 89,235 in the year 2023 (the data from the state of West Bengal was only available till 13 September 2023), of which 485 have succumbed due to it.[9] The actual situation would have been much worse as data from some of the states are not routinely reported.

Furthermore, if we talk about the dengue situation in Uttar Pradesh, the largest state of India by population, a total of 35402 confirmed cases and 36 deaths were reported in 2023, a record highest in last five years (Figures 1 and 2).[10] However, media reports reported a much higher number of deaths than the actual reported figure. Patients were being reported from not just urban but also semi-urban and rural locations. State capital, Lucknow, emerged as a dengue hot spot with the highest number of reported infections at 957. Other severely affected areas include Moradabad (944 cases), Gautam Buddha Nagar (819 cases), Kanpur Nagar (816 cases) and Ghaziabad (732 cases).[11]

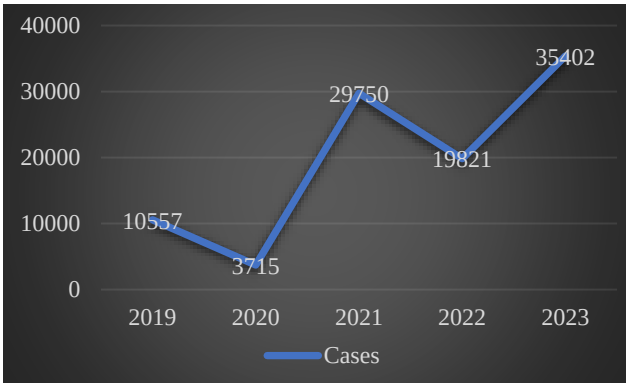

Figure 1: Trend of dengue cases in Uttar Pradesh, 2019-2023.

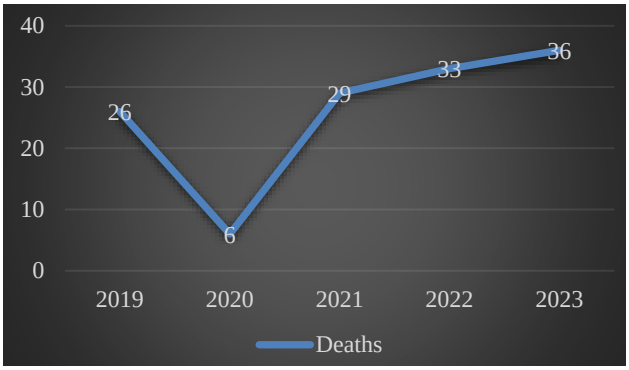

Figure 2: Trend of dengue deaths in Uttar Pradesh, 2019-2023.

EPIDEMIOLOGY OF DENGUE

Dengue fever (DF), a viral vector born disease transmitted by infected *Aedes* mosquitoes, is a major public health concern globally. Dengue is caused by a virus of the Flaviviridae family and there are four distinct, but closely related, serotypes of the virus that cause dengue i.e. DEN-1, DEN-2, DEN-3, and DEN-4.[12] DEN-2 is frequently associated with severe dengue (SD) infections and major epidemics globally. DEN-2 consists of six genotypes such as Asian/American, Asian I, Asian II, Cosmopolitan, American, and sylvatic. DF is not only becoming more common in recent years, but it is also expanding to new geographical areas. Local environmental conditions are known to influence mosquito vector density, which in turn influences DENV transmission.[12] The probability of DENV transmission increases with increasing temperature and absolute humidity. An increase in built-up area, a proxy for urbanization, was determined to be another predictor of increasing dengue incidence. The mosquitoes breed in very small collections of clean water. The mosquito usually becomes infective 8–12 days after biting an infective dengue patient. After being bitten by an infected mosquito, a vulnerable person develops dengue illness after an incubation period of 5–7 days. The illness occurs throughout the year with a peak during monsoon and post-monsoon season due to high vector density.

Majority of the time, the disease is mild and self-limiting, with only about 5% of people developing complications. There are three classic stages: Febrile, critical, and convalescent.[13] DHF and dengue shock syndrome (DSS), the worst types of this disease, have been observed in all regions of India. There has been a temporal change in the prevalence of certain clinical symptoms in the decade following the first epidemic. Shifting serotypes (DEN-1 to 2, 3, and 4) were thought to be responsible for the variation in clinical presentation during the outbreaks and re-infection. However, detailed serotype data for each incidence are still lacking.[15] A high fever, headache, myalgia, body aches, vomiting, joint pain, a transient rash, and minor bleeding signs such as petechiae, ecchymosis at pressure sites, and venipuncture bleeding characterize the febrile phase of DF. The patient's chance of developing to DSS is enhanced in the critical phase that follows, which is defined by plasma leakage that can lead to shock and fluid buildup (ascites or pleural effusion) with significant bleeding without breathing problems and severe organ damage.[15]

A hospital study assessing the trend of dengue virus infection at Lucknow, North India from 2008-2010 reported a gradual increase in number of dengue fever cases with highest occurrence in 2010. Serotypes circulating in years 2008, 2009 and 2010 were DV-2 and DV-3, DV -1, 2 and 3 and DV-1 and DV-2 respectively implying change in circulating serotypes over the year.[16]

A study from Eastern Uttar Pradesh and adjoining region of Bihar showed that DEN-2 was the only serotype which was prevalent in this geographical area. DEN-2 was the only serotype amplified in serotype-specific reverse-transcription PCR from sera of 210 (65.21%) among 322 positive patients. This represent that the DEN-2 circulating strains of DENV are responsible for the most of the outbreaks in North India in recent years.[17]

PROSPECTS OF VACCINE

Dengue vaccines are limited in number and no single vaccine has not yet been approved for use in India. Since last two decades, efforts were put globally to develop safe and effective vaccines to prevent dengue virus (DENV) infections but were faced with several challenges, mainly related to the complexity of conducting long-term studies

to evaluate vaccine efficacy and safety to rule out the risk of vaccine-induced DHS/DSS, particularly in children. At least seven DENV vaccines have undergone different phases of clinical trials; however, only three of them (Dengvaxia®, TV003, and TAK-003) have showed promising results. Denvaxia® is currently the only licenced vaccine, but phase III clinical trials with two other vaccines, TV-003/TV-005 and TAK-003, are currently ongoing, with promising results.[15] TAK-003, a live attenuated tetravalent dengue vaccine candidate based on a DEN-2 backbone developed by Takeda, is being tested in a long-term clinical trial in eight dengue-endemic countries. Over a 3-year period, TAK-003 was effective against symptomatic dengue. Efficacy declined over time, but it was still effective against hospitalized dengue.[15]

CONCLUSION

In conclusion, the scourge of dengue will continue to persist for some time this year too until the environmental temperature persistently drops below 20°C, when breeding of the mosquitoes will stop naturally. However, certain urgent measures are required to be taken such as use of mosquito nets and repellents, larvicidal fish in water bodies, and fogging of insecticides. An integrated prevention and control strategy, early case detection and epidemiological studies, along with last but not the least most effective vaccine development should be taken into the account for effective dengue control in long run. The dengue epidemic in the state of Uttar Pradesh should be contained sooner rather than later by strengthening and expanding the surveillance system, bolstering community capacity, and addressing sociolect-cultural causes. Finally, ensuring adequate cleanliness, hospitalization, and public knowledge is crucial in combating the dengue epidemic.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Bashar MA, Begam N. Dengue outbreak of 2023 in the state of Uttar Pradesh, North India: lesson learnt and way forwards. Int J Community Med Public Health 2025;12:1128-30.